AIR POLLUTION AND ITS EFFECTS ON URBAN ENVIRONMENT

DR. N. VENKATAIAH

Abstract:

The quality of urban environment has deteriorated seriously mainly due to air pollution. The WHO has classified Delhi as one of the ten most polluted cities in the world. Pollution levels in other Indian cities are also alarming.

Air pollution is considered to be one of the most dangerous and common kind of environmental pollution that has been reported in most industrial towns and metropolitans of India and abroad such as Delhi, Mumbai, Calcutta, Madras, Kanpur, Hyderabad, Jaipur, Ahmedabad, Nagapur, Ferozabad and also in London, New York, Tokyo, Pittsburg, etc.,

Causes of Air Pollution in Urban Areas

Air pollution in any city is caused due to emission of dust, chemical fumes, abnoxious gases like hydrocarbons, oxides of sulphur, oxides of nitrogen (NO_x), ozone and ammonia etc., from petrochemicals, cement and textile factories, thermal power stations, automobiles, domestic firewood, coal and biomass combustion and other natural resources.

Vehicles in cities pump into the atmosphere millions of tones of carbon monoxide, hydrocarbons, nitrogen oxide and sulphur dioxide. In certain areas of the cities, the ambient SO_2 and NO_2 concentrations have almost reached the upper margin of critical levels. The CPCB has found critical levels of SO_2 in the cities of Surat and Howrah; NO_2 in Delhi and Howrah; and suspended particulate matter (SPM) in almost all the cities of Bihar, Gujarat, Himachal Pradesh, Madhya Pradesh, Rajasthan, West Bengal, Delhi and Union Territory of Pondicherry.

The Impact of air pollution are as fallows:

(1) **On materials:** abrasion, corrosion, deposition, direct and indirect chemical attack, discolouration, cracking and reducing tensile strength; (2) **On human health:** respiratory illness for children (NO_2), fatigue, headache, weariness (CO_2) and irritation; (3) **On atmosphere:** reduced visibility, foggy-cloudy weather, etc.; (4) **On vegetation:** NO_2 and SO_2 damage vegetation.

Other adverse global effects of air pollution which are well known are as follows:

Global Warming (The Green House Effect): If the burning of the fossil fuels continues at the present rate, the amount of CO_2 will be double in the atmosphere within coming 50 years causing an increase in temperature from 2 degree C to 5 degree C. This incident would be enough to melt the Antarctic ice sheet and raise the sea level by 5 metres

Dean, Faculty of Education, Professor and Chairman, Department of Studies in Education University of Mysore, Manasagangothri, Mysore - 6, Karnataka, India.

submerging Leningrad, New York, Washington D.C., London, Stockholm, Calcutta, Singapore, Jakarta and many other cities and islands like Carreebian will be submerged.

Photochemical Smog : Two pollutants of the atmosphere - Nitrogen oxide and hydrocarbons react with one another in sun light to produce PAN, a cloudy compound appearing in the air. The human eye gets irritated after 12 hours of exposure to PAN. It can damage the leaves and stomatal tissues and cause head ache to human beings.

Acid Rains : The reaction of SO_2 and NO_2 with water in the atmosphere produce sulphuric acid and nitric acid which may come down to the surface as acid rain. Acid rains affect forests, grass lands and all agricultural crops; damage the fertility of the soil; kill all adequate life including fish, planktons and other animals cause skin diseases.

Depletion of Ozone Layer : Nitrogen oxides are potential catalysts for the destruction of ozone. Halogen compounds like freons have a major role in ozone depletion. Any depletion of ozone will result in skin cancer, reduction in crop productivity. A minimum of 140 plants and animal species are disappearing each day because of ozone depletion.

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Air Pollution

According to the latest view point, air pollution is defined as "substances introduced into the air by the activity of manking in such concentrations sufficient to cause serious effects on his health, vegetables, property or interference with the enjoyment of his property."

Air is never found absolutely clean in nature. Pollution of air started from the very moment when the primitive man knew to make fire; since then it has increased and still increasing every moment. Atmosphere i.e., air sector is continuous which diffuse and disperse the air pollutant at a greater rate with faster action.

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Howrah; NO_2 in Delhi and Howrah; and suspended particualte matter (SPM) in almost all the cities of Bihar, Gujarat, Himachal Pradesh, Madhya Pradesh, Rajasthan, West Bengal, Delhi and Union Territory of Pondicherry. The automobile exhausts are responsible for more than 75 per cent of total air pollution.

A large number of industries such as chemical industries, paper and pulp mills, cotton mills, metallurgical plants and smelters, petroleum refineries, mining and synthetic rubber industries are responsible for about 20 per cent of air pollution. The common pollutants of these industries are various types of inorganic and organic gases and materials in the smoke they produce. The most common pollutants are CO_2, CO, SO_2, H_2S, NO, NO_2 etc. In addition, the smoke coming out from their chimneys also contains small particles of dust, carbon, metals, other solids, liquids and even radio active materials which get mixed in the smoke and pollute the air. All such gases and suspended particles in them are injurious to human health.

ADVERSE EFFECTS OF AIR POLLUTION

There are many adverse effects of air pollution.

a) **Damage of Properties :**

Atmospheric pollutants come in contact with the buildingstructures and other properties. Due to their depositions, there will be physical or chemical reactions. The presence of moisture in the atmosphere, may accelrate these reactions. The ultimate effect would be discolouration and disintegration of the surfaces of buildings and structures.

b) **Damage to Vegetation:**

The atmospheric pollutants will change the contents of the air. The pollutants may be deposited on the leaves of the trees and choke their poles. Both will adversely affect the growth of the vegetations.

c) **Obstrution to sight:**

Air pollution causes the formation of haze or smog. Clear vision of the sight is obstructed. This creates difficulty in movement of traffic and there will be more changes of accidents.

d) **Health hazards :**

Atmospheric pollution will cause health hazards to both man and animals. Several diseases of respiratory system in short known as pneumoconiosis or pulmonary diseases, are caused due to air pollution. Examples of some such diseases and the corresponding pollutants are given in the following table :

Diseases from Air Pollution

SL. No.	Causative Agents		Diseases
01.	Rock handling	...	Silicosis
02.	Cement plant	...	Silicosis
03.	Hide handling	...	Antharx
04.	Cotton dust	...	Byssinosis
05.	Smog	...	Asthma
06.	Coal dust	...	Tuberculosis
07.	Asbestos dust	...	Asbestosis
08.	Iron dust	...	Siderosis
09.	Copper particles	...	Chalcosis
10.	Lead fumes	...	Plumbosis
11	Bagasse or Sugarcane dust	...	Bagassosis

Automobile Exhaust

About 40 to 60 per cent of total air pollution of a city is generally caused by automobile exhaust alone. The table given below shows the various air pollutants from automobiles and their effects :

Air Pollutants and their Effects

Air Pollutant	Effect
Particulates	: Accelerate chemical reactions, obscure vision, corrode metals, cause grime on belongings and buildings and aggravate lung illness.
Sulphur dioxides	: Cause acute and chronic leaf injury, attack wide varieties of trees, irritate upper respiratory tracts, destroy paint pigments, erode statuary, harm textile and disinte grate book pages and leather.
Hydrocarbon (in solid or gaseous forms)	: May be cancer producing (Carcinogenic), retard plant growth and cause abnormal and bud development.
Carbon monoxide	: Causes headache, dizziness, nausea, absorbed into blood, reduces oxygen content and impair mental processes.
Nitrogen oxide	: Causes leaf damage, irritates eye and nose, creates brown hedge and corrodes metals.
Oxidents ozone	: Discolours upper surface of leaves, trees, shrubs, damages and fades textiles, reduces athletic performance, hastens cracking of rubber, disturbs lung function and induces coughing.
PAN (Paroxy acety 1 Nitrate)	: Discolours lower leaf surface, irritates eyes and disturbs lung function.

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In some urban areas, the rate of population very frequently exceeds the capacity of the atmosphere to purify itself by natural processes by dilution and dispersion. During these periods, severe air pollution takes place and is clearly manifested by eye irritation, reduced visibility and other adverse effects.

Air Pollution - A Cause of Concern in Developing Countries

1. A World Bank Report (May 1992) has warned that as many as 400 million city dwellers in developing countries will be exposed to unhealthy and dangerous levels of air pollution by the end of the century.

2. About 600 million motorised vehicles are on the world's roads today and in a little more than two decades the number is expected to double, with most of the growth taking place in developing countries.

3. By the year 2000, almost 75 per cent of the world's cities with population of at least 10 million people will be in developing countries. In addition, 18 cities with population of between 5 million and 10 million, will also be in developing countries.

4. In many developing countries motor vehicles have no emission control equipment (such as catalytic converters) and so the pollutants such as sulphur and nitrogen oxides would contribute to acid rains which could destroy forests and eat slowly through buildings and infrastructure. Other pollutants such as CO_2 cause green house effect.

The situation calls for an urgent action on the part of developing countries to prevent the problem from getting out of control.

Air Quality and Indian Cities

NEERI, Nagpur (1980-81) collected data from Delhi, Calcutta, Bombay, Cochin, Ahmedabad, Kanpur, Hyderabad, Jaipur and Madras to assess and visualize the deteriorating air quality due to indstrialisation, urbanisation and the application of latest technology. Their survey carries residential, commercial and industrial situations of all these ten cities.

Calcutta is severely affected by SO_2 air pollution as compared to Bombay, Delhi, Ahmedabad, Kanpur, Hyderabad, Madras, Nagpur and Jaipur. SO_x level has reached to 80 ug/m3. NO_x level lies in the range of 4 ug/m3 in industrial and residential areas of Jaipur. In 1982, NO_x level has reached to 45 ug/m3 in industrial areas of Ahmedabad and commercial area of Kanpur. The particulate matter as indicated by SPM shows highest concentration in Delhi and Calcutta and lowest in Madras and Bombay. These SPM values exceed the safety limits.

Most Polluted Cities - Mumbai, Delhi and Calcutta

The three big metros in India - Delhi, Calcutta and Mumbai are among the ten most polluted cities in the world.

Mumbai

Mumbai has various industries mainly chemical (523), textile (531) and mechanical workshops (3,348). Besides, there are 32 factories processing rubber or plastic products. In addition, there is a large concentration of chemical units within 30 kms of Mumbai. The Chembur - Trombay areas where the industries are concentrated, showed 3 to 6 times higher values of pollution than the rest of the city.

Mumbai consumes a large quantity of fuel. Three hundred million litres (ml) of furnace oil, 755 ml low sulphur high speed diesel (LSHS), 580 ml high speed diesel (HSD), 108 ml light diesel, 362 ml petrol, 471 ml kerosine and 214 ml of LPG. These consumption levels are increasing at the rate of 10 percent yearly.

Congested road junctions build up high levels of NO_2 and SPM. NO_2 and SPM levels show a rising trend particularly in the suburbs.

The components of transport in terms of air pollution levels is increasing from 399 to 1,538 metric tonnes per day (MTPD). Pollution from industries rose from 438 to 1357 MTPD from 1978 to 1992.

Health Effects

(i) Calculations for 1991 excess effects of air pollution on citizens, show that there are excess (20,000) cases of chronic bronchitis, excess doctor's room visits (76,000), excess asthma (741,000) and bronchitis in children (190,000). There are excess respiratory symptoms (60 million) and hospital admissions. The illnesses do lead to limitation of daily work activities (19 million).

(ii) There are persistent respiratory illness which have not come down despite lower SO_2 levels.

(iii) In the traffic congested sites, there were high frequencies of cough/breathlessness and asthma, high levels of eye irritation, dermatitis and head ache.

(iv) Metallic pollution: Some of the unmeasured pollutants were significant in Chembur. Eg: arsenic, bromine, cadmium, vanadium, chromium, copper, manganese, zinc and ammonia. There is also a significant increase in skin and abdominal illness.

Delhi

Delhi has become one of the most polluted metropolitan cities because a considerably high level of lead were observed at the Moolchand Ashram, Chandni Chowk and Azadpur crossings. The SPM levels found at Redfort, Zakhira and Raja garden were about thrice the upper level of 60 ppm prescribed for industrial areas. These safety levels for residential areas lie from 100 ppm to 150 ppm.

From 1972 to 1992 the number of vehichles raised tremendously from 2,85,000 to over 8,48,000 in Delhi. The number of scooters, cars, trucks etc., has increased from 20,888 to 52,072 upto 1988. In 1980 there were 4,252 buses which have now increased to 16000.

An estimate indicates that nearly 400 Kg of lead, 75% of CO, 50% of hydrocarbons and 40% all oxides are released into Delhi air, polluting the whole sky.

A variety of industrial units in Delhi, have increased from 20,000 to 55,000 and about 44,000 of these are located in residential areas and emitting SO_2, NO_x and acid vapours in air.

The thermal power stations at the Indraprastha Estate, Rajghat and Bodarpur are the chief source of pollutants. Their coal consumption is 2500, 5500 and 10,000 tonnes respectively.

In Delhi, 55,000 industries, three power stations and 15 lakh vehichles have made the atmosphere a virtually overloaded sewer.

Calcutta

It is one of the most polluted cities in India releasing 1100 tonnes of particulate every day from industries, energy houses and other sources. It was estimated that CO

concentration of 38 ppm due to auto exhausts during peak traffic hours in selected points was the highest intensity of air pollutants.

The level of suspended particulate matter (SPM) measured 530 microgram per cubic metre is more than 3 times the permissible limit.

Compared to Mumbai, the air pollutant bodies in Delhi and Calcutta, particularly for SPM and aldehydes, are higher. These lead to a greater prevalence of dense smog in winter. The major cause is the greater density of two/three wheelers and widespread use of coal-burning.

Suggestions for Controlling Air Pollution in Urban Areas

1. While the industrial growth of cities cannot be stopped, it is necessary to run industries with greater control of emissions.

2. As automotive vehicles cannot be wished away, it is essential to at least clear obstructions at the main traffic junctions and around bus/train terminuses. To reduce traffic stagnation, bottlenecks have to be cleared.

3. As yound children (below five years) in slums and small houses suffer more, cooking fuel (LPG, CNG) should be made available on priority in urban areas to reduce indoor pollution. This measure alone with an availability of smaller weight cylinders (eg. 3 Kg) will prevent the use of inferior cooking fuel (eg. waste, plastic, wood and cow dung).

4. Vehicles with old technology should be barred from big cities.

5. Three/two-wheelers should be upgraded to four-stroke engines or given two to four years for conversion to four-wheeled vehicles.

6. Heavy duty vehicles should not be allowed to ply on the inner city trunk roads at peak hours (8.00 am to 12.00 noon and 4 to 8 pm) so as to reduce traffic stagnation.

7. To encourage the introduction of modern technology in vehicles, the price difference between diesel and petrol should be minimised as diesel is a greater source of pollutant releases.

8. Modern cars with electronic fuel injection (instead of fancy gadgets like centralised window locking and glass raising) should be encouraged.

9. Catalytic convertors should be made compulsory for all petrol driven vehicles and dieselised vehicles must have a particle trap.

10. We should manage traffic better by allowing wide roads and spacing of bus terminases and bus stops should be located away from crowded junctions. At present, in many cities, bus stops are located next to traffic signals, thus blocking the flow of vehicles.

11. We need to redesign main junctions which presently slow down the flow due to rotary effect.

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